



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/409,644	10/01/1999	NATHAN S. LEWIS	CIT1250-2	5684

20985 7590 05/07/2003
FISH & RICHARDSON, PC
4350 LA JOLLA VILLAGE DRIVE
SUITE 500
SAN DIEGO, CA 92122

EXAMINER

SODERQUIST, ARLEN

ART UNIT PAPER NUMBER

1743

DATE MAILED: 05/07/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.
09/409,644

Applicant(s)
Lewis et al.

Examiner
Arlen Soderquist

Art Unit
1743



-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on Mar 4, 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 50-72, 85-90, 98-110, 112-123, and 126-159 is/are pending in the application.
- 4a) Of the above, claim(s) 50-72 and 85-90 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 98-110, 112-123, and 126-159 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
*See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s). 25 6) ☐ Other:

1. Claims 112, 123 and 159 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In claim 159 it is not clear if a plurality of sensors are required to have a sensing area as described in claim 108 for the at least one sensor or if the claim fails to limit claim 108 because there are already a plurality of sensors in claim 108. Examiner suggests replacing the language starting at "wherein" with --wherein a plurality of sensors comprise at least two conductive leads and a sensing area comprising alternating interpenetrating regions of ... in electrical communication with the at least two leads--. This would use the language of claim 108 and clarify the above question and better lead into claims 112 and 123.

2. The following is as a quotation of 35 U.S.C. 103(as a) which forms the basis for all obviousness rejections set forth in this Office action:

(as a) as a patent may not be obtained though the invention is not identically disclosed or described as a set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing as a background for determining obviousness under 35 U.S.C. 103(as a) are summarized as follows:

1. Determining the scope and contents of the prior art.
 2. Ascertaining the differences between the prior art and the claims at issue.
 3. Resolving the level of ordinary skill in the pertinent art.
 4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
3. Claims 98-110, 112-123 and 126-159 are rejected under 35 U.S.C. 103(as a) as a being unpatentable over Gibson in view of Casella, Thackeray, Yamato, Galal, Naarmann, Li (Materials Research Society Symposium Proceedings, 1995), Sakaguchi, Sestak, Torsi or Wampler and Breheret, Mifsud (both US 5,801,297 and WO 95/08113), Moy or Persaud (WO 86/01599). In the patent application Gibson teaches an odor sensor. as a personnel recognition sensor comprises as a multiplicity of differentially responding chemo-resistor elements, each

element comprising as a nonconductive substrate, as a plurality of electrodes disposed on the substrate and one or more layers of as a conductive polymer overlaying the electrodes, the conductive polymers of at least two of the elements being different; as a detector responsive to signals provided by the multiplicity of elements and arranged to provide an output signal characteristic of the multiplicity of signals; the elements being disposed in as a housing having an inlet arranged so that as a gaseous sample passing into or through the inlet contacts all of the elements in use. Page 12 teaches as a material having two different monomers used to form as a copolymer which examiner is treating as a within the scope of two different conducting materials. Page 13 shows several different polymeric materials that are usable in the invention along with ionic dopants for incorporation into the conducting films. In the paragraph which these components are taught Gibson also teaches that copolymers and blends of the polymers listed can be used as a the polymer. Pages 14-15 teach the materials used as a sensing materials in the sensor of figure 1. Gibson does not teach the extent of the compositions in which the two conductive materials are mixed together to form as a single sensing material having the compositionally different conductive material within the conductive organic material or as a sensing array having sensors that are not organic polymer based.

In the paper Casella discusses copper dispersed into polyaniline films as a an amperometric sensor in alkaline solutions of amino acids and polyhydric compounds. As a chemically modified electrode composed of copper microparticles dispersed into as a polyaniline (PANI) film was studied as a an amperometric sensor of scanty electroactive compounds possessing -OH and -NH₂ groups. Glassy carbon was used as an electrode material and modified firstly by a PANI film, then allowed to stand in contact with a solution of copper ions, and finally, the electroreduction was done at -0.3V. Page 220 in the sentence which bridges the two columns teaches that about 12% of the deposited copper was dispersed (able to penetrate) in the polymer matrix. The electrochemical behavior of the resulting modified electrode in alkaline medium was examined by cyclic voltammetry and flow-injection amperometry. Using some representative compounds, the effect of copper loading and pH on the electrode response was studied. Constant-potential amperometric detection was applied in conjunction with anion-

exchange chromatography (AEC) separations of amino acids and carbohydrates. At an applied potential of 0.55 V vs. Ag/AgCl, the detection limits ($S/N = 3$) for all analytes studied ranged 5-15 pmol, and the linear dynamic range was three-four orders of magnitude above the detection limits. The resulting modified electrode was found to retain 95% of its initial response in flowing streams for 3 hours of operating time. From the title at least it is clear that the copper particles are dispersed **into** the polyaniline films.

In the paper de Lacy Costello teaches composite organic-inorganic semiconductor sensors for the quantitative detection of target organic vapors. Composites of tin dioxide (an n-type semiconductor) and derivative of the conducting polymer polypyrrole (a p-type semiconductor) gave reversible changes in electrical resistance at room temperature when exposed to a range of organic vapors. The optimum amount of polymer giving highest sensitivity was found to be 2.5% by mass for the polypyrrole chloride-tin dioxide composite. Composites containing 2.5% polymer by mass, but differing in polymer derivative were fabricated and exposed to low concentrations of ethanol, methanol, acetone, methyl acetate and ethyl acetate. All gave significant and reversible decreases in electrical resistance. Direct comparison with sensors constructed solely of tin dioxide or polypyrrole at room temperature showed the composites to be more sensitive. The gas sensitivity of the composite materials depended on the type of polymer derivative incorporated and the dopant anion associated with the polymer. The composites were simple to fabricate and gave differing response profiles to a range of organic vapors.

In the paper Thackeray teaches chemically responsive microelectrochemical devices based on platinized poly(3-methylthiophene) and shows variation in conductivity with variation in hydrogen, oxygen, or pH in aqueous solution. Microelectrochemical transistors can be prepared by connecting 2 closely spaced ($\sim 1.2 \mu\text{m}$) Au microelectrodes ($0.1 \mu\text{m}$ thick \times $2.4 \mu\text{m}$ wide \times $50 \mu\text{m}$ long) with anodically grown poly(3-methylthiophene). The amount of poly(3-methylthiophene) used involves about 10^{-7} - 10^{-6} mol of monomer/ cm^2 . Poly(3-methylthiophene) can be platinized by electrochemical reduction of PtCl_4^{2-} at the pair of coated electrodes. The change in conductivity of poly(3-methylthiophene) with change in redox potential is the basis for amplification of electrical or chemical signals; the conductivity varies by 5-6 orders of magnitude

upon change in potential from +0.2 (insulating) to +0.7 (conducting) V vs. SCE in aqueous electrolyte. The Pt equilibrates poly(3-methylthiophene) with the O_2/H_2O or H_2O/H_2 redox couples. [Poly(3-methylthiophene)/Pt]-based transistors are shown to be viable room-temperature sensors for O_2 and H_2 in aqueous solution. The O_2 reproducibly turns on the device, with 1 atmosphere of $O_2/0.1$ M $HClO_4/H_2O$ showing 0.7-mA I_D at a $V_D = 0.2$ V; H_2 reproducibly turns off the device, with 1 atmosphere of $H_2/0.1$ M $HClO_4/H_2O$ showing less than 20-nA I_D at a $V_D = 0.2$ V, where V_D (drain potential) is the applied potential between the 2 Au microelectrodes and I_D (drain current) is the current that passes between the 2 microelectrodes. The turn on with O_2 is complete within 2 minutes, and the turn off with H_2 is complete within 0.3 minutes. A platinized microelectrode of a dimension similar to the microelectrochemical transistor shows only 1.0-nA reduction current upon exposure to 1 atmosphere of O_2 ; the current amplification of the transistor is thus a factor greater than 10^5 . The transistor device can also reproducibly respond to pH changes in the pH range of 0-12, when there is a constant O_2 concentration; there is a reproducible change in I_D to alternate flow of a pH 5.5/pH 6.5 stream for over 10 h. The device responds to an injection of 10^{-6} L of 0.1 M $HClO_4$ into an effluent stream of 0.1 M $NaClO_4$ (flowing at 2 mL/min) within 4s. Study of the resistance properties of [poly(3-methylthiophene)/Pt] vs potential reveals that Pt has little effect on the intrinsic conductivity of poly(3-methylthiophene). Rather, the role of Pt is purely as a catalyst to allow equilibration of O_2 and H_2 with the polymer. The amount of Pt used is approximately 10^{-7} mol/cm², and microscopy shows Pt to be present as a particle of less than 0.1- μ m size.

In the paper Yamato presents a new method for dispersing palladium microparticles in conducting polymer films and its application to biosensors. Composite films of polypyrrole/sulfated poly(β -hydroxyethers) (PPy/S-PHE) are electrically conducting and mechanically flexible. Palladium particles were dispersed in the films by thermally decomposing bis(dibenzylideneacetone)palladium(0) complex which had been absorbed by the films from a $CHCl_3$ solution. This method for loading metal particles was enabled by the high affinity of the composite films for organic compounds. TEM and energy-dispersive x-ray spectrometry (EDX) analyses revealed that fine palladium particles in the nanometer range are dispersed in the PPy/S-

PHE conducting films. a glucose sensor based on the detection of hydrogen peroxide was prepared by immobilizing glucose oxidase (GOD) using glutaraldehyde on a Pd/PPy/S-PHE electrode. This biosensor responded to glucose even at 400 mV vs. Ag/AgCl, which is lower than the working potential of conventional glucose sensors prepared on a platinum electrode.

In the paper Galal teaches electrocatalytic oxidation of some biologically important compounds at conducting polymer electrodes modified by metal complexes. Conducting poly(3-methylthiophene) electrodes were electrochemically prepared. The resulting polymer films were modified with an inorganic/organic complex, ferrocene. The incorporation of the ferrocene/ferrocenium moiety into the polymer film resulted in enhanced charge transfer towards the oxidation of some organic molecules of biological interest. The electrochemical response of the complex-containing polymer electrode was compared to that of the unmodified polymer electrode and that of the substrate. Apparent diffusion coefficients of the redox species were estimated from the cyclic voltammetric data for different biological molecules at the ferrocene-containing polymer electrode. Infra-red spectroscopic measurements for the "as-grown" films revealed the presence of the inorganic/organic complex within the polymer. The modified polymer electrode showed noticeable enhancement for the charge transfer across the film interface and can be used as an electrochemical sensor for biological compounds.

In the published application Naarmann teaches manufacture and use of electrically conductive polymers of five-membered heterocyclic compounds and anions of tetrathiafulvalene derivatives. The polymers are prepared by electrochemical oxidative polymerization of 5-membered heterocyclic compound(s) in the presence of conducting salts containing anions of tetrathiafulvalene derivatives. The polymers are used as sensors or battery electrodes. Derivatives of tetrathiafulvalene were synthesized. a solution of 1 part pyrrole and 1 part NH_4 salt of 3,6-di- ω -sulfobenzyloxy-1,2,4,5-benzo-bis(11,11',12,12'-dibenzotetrathiafulvalene) in 100 parts MeCN was electropolymerized by using Pt electrodes. The obtained polymer film had an electrical conductivity of 80 S/cm and showed a superior stability in a 1-week storage in water to a ClO_4^- -containing polypyrrole film.

In the paper Li teaches the preparation and characterization of polyaniline-palladium composite films. Electrosynthesized polyaniline (PANi) can be chemically functionalized by incorporation of palladium clusters. The functionalization of electrochemically, freshly prepared and dried PANi film occurs spontaneously during the relaxation process. This process is carried out in sulfuric acid containing palladium salt. The material properties of the new composite PANi-Pd film were investigated by applying electrochemical, UV-visible spectroscopic and surface microscopy techniques. The PANi-Pd composite materials behaved electrochemically different than PANi film alone or Pd film deposited electrochemically. This finding is particularly important for developing layers for chemical gas sensors, electrocatalysis or supercapacitors applications.

In the published application Sakaguchi teaches electrodes for gas sensors using electrode reaction. The electrodes consist of a composite of a resin compound, a conductive resin compound, and optionally an organic metal complex compound. Preferably, a conductive resin compound is manufactured by chemical oxidation polymerization or electrolytic polymerization. The gas sensors are useful for detection of gas components in exhaust gases and combustion waste gases, and have long life. From the attached Chemical Abstracts abstract it is clear that at least polypyrrole is disclosed as a conductive resin and cobalt phthalocyanine are disclosed. The JPO abstract teaches iron or platinum complexes with phthalocyanine and naphthalocyanine also being used.

In the paper Sestak teaches selective hydrogen sensors based on conducting polymers. As part of a program focussed on the development of selective conducting polymer gas sensors, the authors have studied the behavior of polyaniline-platinum oxide chemoresistors in the presence of combustible gases such as hydrogen, methane, ethylene, acetylene and carbon monoxide. The authors report on results obtained using a polyaniline-platinum oxide sensor. By hydrogen atmosphere preconditioning, the authors were able to increase the selectivity and sensitivity of the sensors for hydrogen in air at concentrations between 1000 and 5400 ppm. The introduction teaches some of the ways in which conducting polymer films have been used as sensor materials

including chemoresistors and electrochemical cells along with advantages and/or disadvantages of the respective formats.

In the paper Torsi teaches conducting polymers doped with metallic inclusions as new materials for gas sensors. Electrochemically synthesized conducting polymers, such as polypyrrole and poly-3-methylthiophene, were doped with copper and palladium inclusions. These metals are deposited potentiostatically either on the pristine conducting films or on the partially reduced samples. The procedure to form the inclusions in the polymer matrix is found on page 363. Gas sensor devices based on these doped organic films show interesting performances in detecting reducing gases such as NH_3 , H_2 and CO .

In the paper Wampler discusses the chemical synthesis and characterization of composites of polypyrrole and carbon black. a new class of molecular composites of carbon black and an electronically conducting polypyrrole has been synthesized by chemically polymerizing pyrrole in an aqueous dispersion of carbon black. The carbon black content of these composites can be varied from ~5% to ~85% (by weight). The surface areas and densities of these composites were compared to corresponding mixtures of carbon black and polypyrrole. The influence of carbon black on the efficiency of polymerization of pyrrole is described. The effect of carbon black content on the electronic conductivity of the composite has been mapped, and compared with the corresponding behavior of a mixture of carbon black and poly(vinyl chloride). The influence of the parent black characteristics (porosity, void vol., surface area) on the electronic conductivity of the resultant composite has been probed by comparing the behavior of composites derived from six commercial and experimental blacks. The temperature dependence of the composites has been studied as a function of the carbon black content. The application of these new materials is examined. The first page of the paper teaches that these potential application include sensors, electrocatalysis, super capacitors and fuel cells. In the sentence bridging pages 1811-1812 Wampler teaches that other similar composites of conducting polymers with polymers, metals, or metal oxides has extended the scope of their use. The paper clearly shows that the composite is superior to either component of the composite when applied to the electrocatalysis of chromium(VI) to chromium(III).

In the paper Breheret presents online differentiation of mushrooms aromas by combined headspace/multi-odor gas sensors devices. a specially designed measurement cell for direct headspace analysis, online connected to (I) a gas chromatograph equipped with an headspace injector and a sniffing-port, (ii) multisensors devices: five semiconductor gas sensors and twenty conducting polymer gas sensors, was used to discriminate nine mushrooms' aromas. The raw data of gas sensors were statistically processed, and provided pictorial presentation under sample distribution in a plan, allowing to compare the different mushrooms' aromas, with the GC/sniffing analysis. Semiconductor gas sensors succeeded in classifying four groups based on overall odor. Semiconductor gas sensors seem to be more appropriate for the mushrooms aromas discrimination than conducting polymer gas sensors. These preliminary results confirm the interest of such technologies for chemotaxonomy differentiation of wild mushrooms.

In the patent and patent application Mifsud teaches methods and devices for the detection of odorous substances and applications. a device for carrying out a method of odor detection including, in particular, a plurality of chambers, each having a plurality of semi-conductor gas sensors, conductive polymer gas sensors, surface acoustic wave gas sensors, as detection means, a variable flow gas pump for forming a gas flow in said chambers, measurement electronic device for operating the detection means, a data processing unit for recording in a file the olfactory prints obtained using the detection means, and for comparing the detected impressions with those in the file so that odors may be identified and recognized. Applications, especially to drugs, explosives, body odors and food seals.

In the paper Moy discusses transient signal modeling for fast odor classification. The Fox 2000 is an electronic nose system using an array of 6, 12, or 18 gas sensors. The anal. of sensor signals coming from a combination of metal oxide sensors and conducting polymer elements indicates the ability of predicting in only a few seconds the nature of a sample (hams, sausages, cereals...) from its olfactory fingerprint. The simulation of the signals is performed via exponential functions and applied to various foodstuffs. Online and real time Artificial Neural Network (ANN) have also been investigated for fast odor classification and recognition. Six different brands of sausages (pure pork, beef/pork sausages) have been analyzed using a 6-

element array. Six samples of each type of sausage were measured 12 times and discriminant analysis was performed over the set of 72 samples using the raw data of acquisition. 94% Of the samples were correctly classified and cross validation (testing unknown samples) gave an overall success rate of 83% correctly classified samples. These results indicate the possibility to use electronic noses and pattern recognition methods for fast odor classifications.

In the published application Persaud teaches gas sensors. a sensor for gases, vapors, or odors has an organic polymeric semiconductor element which changes its electrical resistance in the presence of certain gases. The polymer is formed by electrolytic deposition on the substrate from a solution of its monomer, the solution comprising a solvent medium in which the monomer is sparingly soluble, a protic solvent, and an ionic base. a number of different gas detectors can be used to obtain from each a characteristic response to the presence of a gas, and the combination of responses can be used to distinguish between gases. The different detectors may be all based upon organic polymers, or one or more detectors may use other principles such as flame ionization or gas chromatography. The sensor is useful in monitoring industrial environments, gas liquid chromatography, quality control in food and drinks production, and food production. Page 14, line 2-9 teach that the different types of sensors can allow the device to detect between odors that it might not otherwise be able to discriminate. Page 16, lines 15-21 teach that an alternative form of the sensor is as a polymer coated field effect transistor.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teachings of Casella, de Lacy Costello, Thackeray, Yamato, Galal, Naarmann, Li, Sakaguchi, Sestak, Torsi or Wampler relative to the incorporation of conductors such as carbon black, metal particles or metal oxide into the conductive organic polymers used in the sensing arrays of Gibson because of their sensitivity to known analyte gases or enhanced sensing and/or stability properties as taught by each of Casella, Thackeray, Yamato, Galal, Naarmann, Li, Sakaguchi, Sestak, Torsi or Wampler compared to sensors made with only the conductive polymers taught by Gibson. It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate other types of sensors such as the metal oxide and/or surface acoustic wave devices taught by Breheret, Mifsud, Moy or Persaud into the

Gibson device because of the ability to use them in combination to discriminate odors that would not easily be discriminated by a single type of sensor as taught by Breheret, Mifsud, Moy or Persaud.

4. Claims 126-127 are rejected under 35 U.S.C. 103(as a) as a being unpatentable over Gibson in view of de Lacy Costello. In the patent application Gibson teaches an odor sensor. as a personnel recognition sensor comprises as a multiplicity of differentially responding chemoresistor elements, each element comprising as a nonconductive substrate, as a plurality of electrodes disposed on the substrate and one or more layers of as a conductive polymer overlaying the electrodes, the conductive polymers of at least two of the elements being different; as a detector responsive to signals provided by the multiplicity of elements and arranged to provide an output signal characteristic of the multiplicity of signals; the elements being disposed in as a housing having an inlet arranged so that as a gaseous sample passing into or through the inlet contacts all of the elements in use. Page 12 teaches as a material having two different monomers used to form as a copolymer which examiner is treating as a within the scope of two different conducting materials. Page 13 shows several different polymeric materials that are usable in the invention along with ionic dopants for incorporation into the conducting films. In the paragraph which these components are taught Gibson also teaches that copolymers and blends of the polymers listed can be used as a the polymer. Pages 14-15 teach the materials used as a sensing materials in the sensor of figure 1. Gibson does not teach the extent of the compositions in which the two conductive materials are mixed together to form as a single sensing material having the compositionally different conductive material within the conductive organic material or as a sensing array having sensors that are not organic polymer based.

In the paper de Lacy Costello teaches composite organic-inorganic semiconductor sensors for the quantitative detection of target organic vapors. Composites of tin dioxide (an n-type semiconductor) and derivative of the conducting polymer polypyrrole (a p-type semiconductor) gave reversible changes in electrical resistance at room temperature when exposed to a range of organic vapors. The optimum amount of polymer giving highest sensitivity was found to be 2.5% by mass for the polypyrrole chloride-tin dioxide composite. Composites containing 2.5%

polymer by mass, but differing in polymer derivative were fabricated and exposed to low concentrations of ethanol, methanol, acetone, methyl acetate and ethyl acetate. All gave significant and reversible decreases in electrical resistance. Direct comparison with sensors constructed solely of tin dioxide or polypyrrole at room temperature showed the composites to be more sensitive. The gas sensitivity of the composite materials depended on the type of polymer derivative incorporated and the dopant anion associated with the polymer. The composites were simple to fabricate and gave differing response profiles to a range of organic vapors.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teachings of de Lacy Costello relative to the incorporation of conductors such as metal oxide into the conductive organic polymers used in the sensing arrays of Gibson because of their sensitivity to known analyte gases or enhanced sensing properties as taught by de Lacy Costello compared to sensors made with only the conductive polymers taught by Gibson.

5. The declaration filed on March 4, 2003 under 37 CFR 1.131 has been considered but is ineffective to overcome the Sestak et al., Torsi et al. and Galai references. The evidence submitted is insufficient to establish a conception of the invention prior to the effective date of the Sestak et al., Torsi et al. and Galai references. While conception is the mental part of the inventive act, it must be capable of proof, such as by demonstrative evidence or by a complete disclosure to another. Conception is more than a vague idea of how to solve a problem. The requisite means themselves and their interaction must also be comprehended. See *Mergenthaler v. Scudder*, 1897 C.D. 724, 81 O.G. 1417 (D.C. Cir. 1897). The evidence of conception is required to be commensurate in scope with the teaching of the references. In other words the declaration is required to show that applicant had conceived of the compositions taught by the Sestak et al., Torsi et al. and Galai references. If examiner understands the lab notebook pages submitted as evidence of conception, the highlighted and other entries having "CB" as a part of the notation refer to compositions in which carbon black (CB) was included in the composition. This is fine for a showing that applicant had conceived of carbon black containing compositions prior to the date of the above references. However, there is no record showing applicant having conceived or prepared compositions containing metals (Torsi et al.), metal oxides (Sestak et al.)

and mixed inorganic/organic conductors (Galai) prior to the dates of the respective references. Nor is there probative evidence to show how the compositions including carbon black are commensurate in scope with the inclusion of metals, metal oxides and mixed inorganic/organic conductors in the compositions found in the laboratory notebook pages. Because of this the declaration is ineffective to remove Sestak et al., Torsi et al. and Galai as prior art references for the instant claims.

6. Applicant's arguments filed March 4, 2003 have been fully considered but they are not persuasive. Relative to the rejection under 35 USC 112 2nd paragraph, the language of claim 59 created a question of whether or not the claim further limited claim 108. Relative to the differences between electrochemical sensors and the chemoresistive sensors of the instant invention, examiner refers applicant to the Sestak reference. On page 118 in the first full paragraph after the "Introduction" heading Sestak clearly teaches that conducting polymers based on substituted pyrroles, thiophenes and polyanilines have been used for gas sensing applications in several modes including chemoresistors, electrochemical cells, mass balance sensors and chemFET devices. Thus one of skill in the art recognizes that these conducting polymers can be used for gas sensing in different ways to include both the electrochemical and chemoresistive. In the next paragraph which applicant has cited the first two sentences as showing that Sestak teaches away from using an electrochemical sensor to modify a chemoresistive sensor, the third sentence is important. It show that the emphasized disadvantage is overcome because the polymers have both redox properties and are able to interact with the analyte in a manner that changes the resistance of the polymers. Thus rather than teaching away from the use of electrochemical sensors to modify a chemoresistive sensor it points to the ability of overcoming the disadvantage of stability by using the conductive polymer in a chemoresistive sensor. As further evidence of this, examiner points to the paragraph bridging pages 118-119 of Sestak. That paragraph is reproduced below with added emphasis.

"With respect to hydrogen, either in the gas phase or as hydrogen ions in solution, **platinum group metal microparticles dispersed in polymer modified electrodes have potential applications in gas sensors and electrocatalysis.** The incorporation of metal microparticles into conducting polymers has been reported by a number of groups.

Generally, these efforts have been directed at the development of electrocatalytic electrodes for use in solution. Garnier has reported the incorporation of both platinum and silver microparticles into poly(3-methylthiophene)⁵ while Moutet has described the incorporation of palladium and rhodium into N-substituted polypyrrole films.⁶ Polyaniline has also been used as a matrix for the incorporation of palladium and platinum microparticles.^{7,8} **These modified electrodes were shown to possess excellent stability and high catalytic activity** towards the reduction of hydrogen ions in solution. The fabrication of these modified electrodes has relied upon electrochemical reduction of the polymer in the presence of metal ions, or electrochemical cycling in the presence of both monomer and metal ion. **While this technique provides microparticles of metals evenly dispersed throughout the polymer, it poses a problem in the fabrication of thin film chemoresistors.** Ideally such devices would be readily fabricated using spin coating techniques. **These requirements led us to examine the use of soluble forms of polyaniline for the fabrication of thin-film devices."**

The first emphasized part shows a recognition that microparticle containing conductive polymers have applications as both sensors and electrodes for electrocatalysis. The second emphasized portion shows the excellent stability of the modified electrode as an advantage of microparticle containing conductive polymers. The last emphasized sentence shows how Sestak used the prior art to direct or motivate them in the development of a chemoresistor type of gas sensor. Applicant is also directed to reference 8 of Sestak which is also of record in the instant application. It is clear from the abstract and the first two pages of the reference that the polyaniline-palladium composite films were produce as electrochemical sensors. This reference is similar to the applied Li reference in its disclosure. Thus the citation by Sestak of the Li reference is clearly in contradiction to applicant's position that the Sestak reference teaches away from the use of the applied Li reference since it teaches an electrochemical sensor and was cited in the paragraph explaining background which led Sestak to the investigations which are reported in Sestak.

Relative to the combination of references with Gibson as the primary reference examiner agrees that Gibson does not anticipate the claims. However for the following reasons examiner submits that there is sufficient motivation as a basis for the respective combinations. First, as explained above, one of skill in the art would have looked to the electrochemical sensors for improvements in chemoresistive sensors. With specific reference to the Casella reference

applicant is directed to the sentence bridging the two columns of page 220 and immediately precedes the sentence on that page cited by applicant. In that sentence Casella clearly teaches that about 12% of the deposited copper was able to penetrate the polymer matrix or was dispersed in the polymer matrix. While some of the copper may have been deposited on the polymer as applicant points out, Casella clearly teaches particles dispersed in the polymer matrix. Additionally heading 3.2 --"Electrocatalytic behavior of Cu-PANI film electrodes"-- is clearly the type of reference that motivated Sestak to conduct the experiments which led to the chemoresistor of Sestak.

With respect to the de Lacy Costello reference the rejection has been changed because of the amendments to correct the 35 USC 112 first paragraph problems. The reference is still appropriate for claims 126-127 because there is no requirement on the temperature dependence of the electrical properties of metal oxides in the sensing area composition.

Relative to the Thackeray reference applicant is directed to the preparation of the platinized film as found in the paragraph in the right column of page 6675 beginning with "derivatization of microelectrodes". If one compares the derivatization procedure with that of the preparation of the copper dispersed electrodes of Casella (page 219, left column last paragraph), it becomes clear that the preparation methods are equivalent and therefore a portion of the platinum penetrates or is dispersed within the conductive polymer matrix. The Thackeray reference is also relevant to the instant claims as explained above relative to the use of an electrochemical sensor to modify a chemoresistive sensor.

Relative to the Yamato reference, the instant claims do not exclude the presence of enzymes either in or on the polymer matrix in the sensing area of the device. Thus those comments are not commensurate in scope with the instant claims. The Yamato reference is also relevant to the instant claims as explained above relative to the use of an electrochemical sensor to modify a chemoresistive sensor.

The Galal reference is also relevant to the instant claims as explained above relative to the use of an electrochemical sensor to modify a chemoresistive sensor. Furthermore as explained above, the declaration fails to show that applicant had conceived of the composition of

Galal prior to the date of the reference or how one would have found the composition of Galal equivalent to of obvious over the carbon black composites shown in the declaration.

Relative to the Naarmann reference applicant is directed to instant table 2. In the organic conductors the instant specification lists charge transfer complexes of which the last listed is tetrathiofulvalene complexes. Examiner asserts that this is equivalent to the tetra:thia:fulvalene in the title of the English language abstract. For this reason Naarmann does contain an organic conductor as found in the Markush group of the claims. The Naarmann reference is also relevant to the instant claims as explained above relative to the use of an electrochemical sensor to modify a chemoresistive sensor.

The Sakaguchi and Wampler references are also relevant to the instant claims as explained above relative to the use of an electrochemical sensor to modify a chemoresistive sensor.

As explained above in regards to the declaration, the Sestak and Torsi references are available as prior art because the declaration failed to show conception of the sensing composition of Sestak or Torsi prior to the dates of the references. The declaration also failed to show that the carbon black compositions that are shown in the declaration are equivalent to or would have made obvious the metal oxide and metal containing composition of Sestak and Torsi.

Relative to the Breheret, Mifsud, Moy or Persaud references, they are not intended to teach modifying the polymer composition of Gibson, but are used relative to claims that require sensors of a type other than the sensor material in claim 98. These references are also present for their teachings relative to the structure used to allow the sensors to contact the analyte containing gas.

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO**

MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The additionally cited art relates to materials or structures used in detection sensors.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Arlen Soderquist whose telephone number is (703) 308-3989. The examiner's schedule is variable between the hours of about 5:30 AM to about 5:00 PM on Monday through Thursday and alternate Fridays.

For communication by fax to the organization where this application or proceeding is assigned, (703) 305-7719 may be used for official, unofficial or draft papers. When using this number a call to alert the examiner would be appreciated. Numbers for faxing official papers are 703-872-9310 (before finals), 703-872-9311 (after-final), 703-305-7718, 703-305-5408 and 703-305-5433. The above fax numbers will generally allow the papers to be forwarded to the examiner in a timely manner.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.



May 5, 2003

ARLEN SODERQUIST
PRIMARY EXAMINER